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drography of the Orinoco, not only obtained materials for a geological map of the region, but in five different places discovered inscriptions and pictures in granite, made by the natives. These he has carefully copied.—A party commanded by Feilberg, and sent out by the Argentine Confederation to explore the Pilcomayo, found that a trade route via that river to Bolivia is not feasible. Below the rapids, sixty leagues above the mouth, the Pilcomayo receives an affluent not marked on any chart, but with as much water as the Pilcomayo or perhaps even more. It was obstructed by sunken trees. The country along these rivers is rich with fine pasturage.—From Dr. Bell's report of the geological work of the Hudson Bay expedition, it appears that the highest land of the Labrador peninsula is everywhere close to the coast, with a gradual slope westward to the basins of the Koksoak and the rivers emptying into Hudson bay. The formation throughout Northern Labrador and the strait is gneiss, mostly Huronian, but some of it Laurentian.—Punta Arenas, the Chilian settlement in Magellan strait, is a town of 4000 inhabitants, surrounded by splendid lands with abundant pastures, forests and waters. A hill protects the town from the cold winds. The climate is said to be excellent.

GEOGRAPHICAL NEWS.—The fifth and sixth issues of Petermann's *Mittheilungen* for this year contain an account of Caffraria and the eastern districts of Cape Colony, by H. C. Schunke, with a map (in No. 5) upon a scale of 1 : 750,000. No 5 contains also some remarks upon the health-relations of the region of the Upper Amu Darja, by A. Regel; and an account of the German Geographical Congress held at Hamburg on April 9 to 11, 1885. On this occasion Doctors Steiner and Claus gave an account of their journey down the Xingu, and Dr. Boas a sketch of the Eskimo of Baffin's bay. No. 6 contains a map of the Panama canal on a scale of 1 : 120,000; an account of the German settlements on the Slave coast, by P. Langhans, and a history of ten journeys in Costa Rica, undertaken by the now expelled bishop, Dr. Theil. The coast line of the German possessions on the Slave coast is short, extending only from 1° 15' W. to 1° 34' W. Lome, Bugida and Porto Seguro are situated upon the shore, behind which is a lagoon, the Togo sea, at the mouth of the Raho river. The outlet of this lagoon is at Little Popo, to the east of the Togo territory. Popo is not claimed as German upon the map.

GEOLOGY AND PALÆONTOLOGY.

THE RELATIONS OF THE PALÆOZOIC INSECTS.—At the April, 1885, meeting of the National Academy of Sciences, Mr. S. H. Scudder presented some important views as to the position of the insects of the Palæozoic age in the system. We make the following extracts from his paper:

The modification I would introduce is to this effect: That

while we may recognize in the Palæozoic rocks insects which were plainly precursors of existing Heterometabola, viz., Orthoptera, Neuroptera (both Neuroptera proper and Pseudoneuroptera), Hemiptera (both Homoptera and Heteroptera) and perhaps Coleoptera—and no Metabola whatever—a statement almost identical with that previously made, we may yet not call these Orthoptera, Neuroptera, etc., since *ordinal features were not differentiated*; but all Palæozoic insects belonged to a single order which, enlarging its scope as outlined by Goldenberg, we may call Palæodictyoptera; in other words, the Palæozoic insect was a generalized Hexapod, or more particularly a generalized Heterometabolon. Ordinal differentiation had not begun in Palæozoic times.

The grounds for this view are as follows:

1. No group of Palæozoic insects has yet been studied carefully; and it is important to observe that, though our knowledge of them is of necessity fragmentary, yet the more perfectly they are known the clearer is this true; no group, I say, has been carefully studied which does not show, between it and the modern group which it most resembles, differences so great that it must be separated from that group as a whole, as one of equal taxonomic rank, as in the case of three relative groups last mentioned.

2. That the different larger groups of Palæozoic times, of which we now know nine or ten, were more closely related to one another, at least in the structure of their wings (which is the only point of general structure yet open for comparison) than any one of them is to that modern group to which it is most allied, and of which it was, with little doubt, the precursor or ancestral type. Thus the Palæoblattariæ are more nearly allied in the ground structure of their wings to certain neuropteroid Palæodictyoptera of Palæozoic times than to the modern Blattariæ; and yet we can so completely trace in Mesozoic times the transition from the Palæoblattariæ to the Blattariæ that no reasonable doubt can exist as to their descent, the one from the other.

3. The ordinal distinction which is now found in the wing structure of modern insects did not exist in Palæozoic insects, but a common simple type of neuration which barely admitted of family division.

It will appear from this that, by a sort of principle of family continuity, we may recognize in the Palæozoic insects a tendency toward a differentiation in ordinal characters sufficient to enable us in an *ex post facto* fashion to distinguish between orthopteroid, neuropteroid, etc., Palæodictyoptera.

Now when we look at the insects of later formations, we find types of every one of the existing orders of insects—speaking of these orders in their broadest sense, as we have everywhere done in this essay—we find every one fully developed in the Jurassic period.

We find then that the entire change from the generalized hexapod to the ordinally specialized hexapod was made in the interval between the close of the Palæozoic period and the middle, we may say, of the Mesozoic. These significant changes were ushered in with the dawn of the Mesozoic period, and the Triassic rocks become naturally (together with the Silurian) the most important, the expectant ground of the student of palæontology.

Hitherto for fifty years the Carboniferous period has claimed this interest as its birthright.

It would then appear that the geological history of winged insects, so far as we know from present indications, may be summed up in a very few words. Appearing in the Silurian period, insects continued throughout Palæozoic times as a generalized form of Heterometabola which, for convenience, we have called Palæodictyoptera, and which had the front wings as well as the hind wings membranous.

On the advent of Mesozoic times a great differentiation took place, and before its middle all of the orders, both of Heterometabola and Metabola were fully developed in all their essential features as they exist to-day, the more highly organized Metabola at first in feeble numbers, but to-day, and even in Tertiary times, as the prevailing types. The Metabola have from the first retained the membranous character of the front wings, while in most of the Heterometabola, which were more closely and directly connected with Palæozoic types, the front wings were, even in Mesozoic times, more or less completely differentiated from the hind wings as a sort of protective covering to the latter, and these became the principal organs of flight.

GARMAN ON DIDYMODUS.—Mr. Samuel Garman has published a description¹ of the shark *Chlamydoselachus anguineus* Garm., and introduced into his paper some comments on my paper² on the extinct shark Didymodus, which has been found in the beds of Permian age in Texas. Mr. Garman's comments are in the form of a criticism which denies the existence of some of the leading points of structure of the skull which I have pointed out. The surprise which these criticisms occasion increases when it is understood that they are derived "from a study of the illustrations," and not of the specimens themselves. And Mr. Garman appeals to "a comparison with the plate in the Proceedings" (of the American Philosophical Society) to "show whether they can be justified" (p. 29). To utter the sweeping conclusions reached by Mr. Garman on such a basis as this, is, to say the least, hazardous; and it is a comparatively easy task to show that they are wrong, by reference to the specimens themselves. On p. 573 of

¹ Bulletin of Museum Comparative Zoölogy, Cambridge, XII, July, 1885.

Proceedings American Philosophical Society, Philadelphia, 1884, p. 572.

my essay I state that twelve more or less complete crania of *Didymodus* are in my possession. I now add that most of them were in my possession, and were objects of frequent observation by me, for five or six years before my publication in question.

On p. 29 of his brochure, Mr. Garman says:

"3. The skull is unsegmented; the lines of segmentation, so-called, are partly accidentals which are not alike on the two sides of the skull."

To this it must be replied that the lines of segmentation certainly exist, and that they are alike on the two sides of the skull.

"6. The Fig. 4 of the plate should be reversed in direction, the prolonged anterior portion in the figure should be turned backwards from the interorbital region, thus bringing what in the figure serve as orbits behind the postorbital processes."

As I have several perfect skulls of this species, including the one represented in Fig. 1, where the characters are readily seen, the supposition of Mr. Garman that I have reversed the specimen represented in Fig. 4 is simply curious; and as he derives his information from a plate, one is also surprised at the lack of caution exhibited in making the assertion.

"7. The *Ichthyotomi*, as based on these skulls, have not been separated from the *Selachii*."

The suborder *Ichthyotomi* was thus defined in my paper (p. 581): "A basioccipital bone and condyle. Occipital ? pterotic and frontal bones distinct. Supraorbital (or nasal) bones present." Mr. Garman gets over this definition by denying the existence of the segmentation, which, as we have seen, nevertheless exists; and by ignoring the presence of the basioccipital bone and condyle. This would indeed be the muzzle of the skull, were the direction of Fig. 4 reversed, as proposed by Mr. Garman. As the characters above given are proven to exist, I must still regard the genus *Didymodus* as presenting a type of skull quite different from the true *Selachii*.

I now add a few comments on other points in Mr. Garman's paper. On p. 21 of his essay Mr. Garman gives five references to the publications where he claims that I have called the *Chlamydoselachus anguineus*, *Didymodus anguineus*." I have, however, never proposed or used this name at the places cited, or elsewhere. On p. 28 it is stated that I have never published my conclusion that these two genera are distinct. This was done in the *AMERICAN NATURALIST*, 1885, pp. 236-7. Further, a new name is proposed as a substitute for *Didymodus* (p. 30), because the latter is supposed to have become a synonyme in another connection. Were this the fact, I should still retain as unused the name *Didymodus*, by which the form is now known; but as it has not yet been positively shown to be distinct from some of the various genera of this group already proposed, the action of Mr. Garman is at least premature.—*E. D. Cope*.

ON THE ANTHRACARIDÆ, A FAMILY OF CARBONIFEROUS MACRURUS DECAPOD CRUSTACEA, ALLIED TO THE ERYONIDÆ.¹—Having been kindly favored by Messrs. R. D. Lacoe and J. C. Carr with the opportunity of examining their collections of nodules from Mazon creek, containing *Anthrapalæmon gracilis* Meek and Worthen, I have been able to discover some features probably not shown in the specimens examined by those palæontologists. The newly observed characters are the carapace with its rostrum, showing that the American species in these respects closely resembles the European ones figured by Salter, the founder of the genus. Moreover, specimens show the entire thoracic legs, while the antennæ of both pairs were almost entirely shown. The fact that the first pair of thoracic feet were scarcely larger than the succeeding pairs shows that *Anthrapalæmon* cannot be placed in the Eryonidæ, but should form the type of a distinct group of family rank, none of the existing *Macrura* having such small anterior legs. At the same time the Carboniferous *Anthracaridæ* were probably the forerunners or ancestors of the Mesozoic and later Eryonidæ.

The genus *Anthrapalæmon*, a Carboniferous fossil, was first described by J. W. Salter in the Quarterly Journal of the Geological Society of London, (xvii, 529, 1861). The name given to the fossils has, the author remarks, "only a general signification, and is not intended to indicate a real relation to *Palæmon*." He also remarks that "the genus is not to be confounded with any of the Liassic or Oölitic ones published by von Meyer, Münster, &c. * * * It is broader than the general form of the *Astacidæ*, or than *Glyphæ* and its Liassic allies, but much narrower than Eryon." Salter's type species is *Anthrapalæmon grossarti* Salter. With this species the American *A. gracilis* is congeneric. A closely allied English form of *A. dubius* Prestwich, is referred by Mr. Salter to the subgenus *Palæocarabus*, a name less fitting than *Anthrapalæmon*. The telson, unlike that of any other macruran, fossil or recent, so far as I am aware, is differentiated into three portions: the basal, central piece is somewhat polygonal, a little longer than broad; it is separated by a distinct suture from a small triangular terminal piece which forms the apex of the telson. Between the outer half of the entire telson is a large broad lobe which is fringed with setæ. At first I regarded it as a subdivision of the inner lobe of the last uropoda or abdominal feet, but no instance among the Decapoda is known to us in which the last pair of uropoda have more than two lobes or divisions, and I have therefore been inclined to associate the innermost of the three setiferous lobes with the telson, and to regard the telson as divided into two median and two lateral lobular setiferous portions. Whether the two lobes belong with the telson or uropoda I will leave for the present an open question.

¹ Read before the National Academy of Sciences, April, 1885.

The only group in existence in which the telson is so remarkably differentiated is the Galatheidæ. In *Munida* the telson is divided by sutures into four pieces, the two terminal ones lobed and edged with setæ of the same size as those of the uropoda. In *Eumunida* of Smith the telson is "short and broad, more or less membranaceous, and divided by a transverse articulation, so that the distal part may be folded beneath the basal part." In *Anoplotus politus*, like the foregoing a deep-sea galatheid, the telson is stiffened by eight distinct calcified plates, a broad median basal plate, with a small one on either side at the base of the uropod and a small median one behind it and between a pair of broad lateral plates, still behind which there is a second pair which meet in the middle line and forms the tips and lateral angles.

From the nature of the differentiation of the telson in the Galatheidæ I am inclined to believe, from what I have observed in the specimens before me, that the telson of *Anthrpalæmon* is subdivided in nearly the same manner. If so we cannot refer the genus to the Eryonidæ, and we would therefore regard it as the type of a distinct family which may thus be briefly characterized:

Family Anthracaridæ: Body broad and somewhat flattened, in general appearance like the Eryonidæ, but with the first pair of thoracic legs no larger than the four succeeding pairs; carapace with a long acute rostrum, with lateral spines on the anterior half, the telson differentiated into two median pieces, with two lateral broad rounded membranaceous lobes, fringed like the uropoda with large setæ.

In anticipating the differentiated telson of the anomurous Galatheidæ, this eryon-like shrimp is not an exception to the rule prevailing in the old-fashioned Carboniferous forms, which seem, in most cases, to be synthetic or ancestral types. The Eryonidæ, which began to exist in the Mesozoic age, have persisted to the present time, being represented by certain deep-sea forms, *i. e.*, *Willemoesia* and *Pentacheles*; on the other hand the Anthracaridæ appear to have become extinct at the end of the Palæozoic age, and the question naturally arises: Did they stand in an ancestral relation to the Mesozoic and modern Eryonidæ? Appearances certainly indicate that the Eryonidæ, and perhaps the Astacidæ, may have descended from a group at least closely allied to the Anthracaridæ.—*A. S. Packard.*

THE GEOLOGICAL HISTORY OF NEW ZEALAND.—Capt. F. W. Hutton, in an article upon the origin of the fauna and flora of New Zealand (*Ann. and Mag. Natural History*, February, 1885) arrives at the following conclusions: New Zealand, which formerly existed as the southern part of a continent extending through Australia to India, was isolated from Australia toward the close of the Jurassic period, but was attached to a South Pacific continent and received a stream of immigrants

from the north. None arrived from the south because Fuegia was not then in existence. In the Upper Cretaceous the land shrank to a size considerably smaller than at present. In the Eocene, elevation took place, and New Zealand extended outwards in all directions, but remained isolated. Plants and animals came in both from the north and from the south. In the Oligocene and Miocene periods New Zealand was, except for a short interval, a cluster of islands, but was upraised once more, and obtained more immigrants from north and south during the Pliocene, after which subsidence occurred, and the land throughout the South island and southern half of the North island sank considerably below its present level, to be again elevated during the Pleistocene.

GEOLOGICAL NEWS.—*Jurassic*.—M. Cotteau has studied more than 500 Echini from the Jurassic of France. The Jurassic seas, not very deep, with broken shores, numerous isles and many extensive coral reefs, presented conditions eminently favorable for the existence of Echini. The evolution of the fifty genera described by M. Cotteau is of great interest. Some are special to the beds they occur in, and nothing in the beds above recalls their existence, while others have a curious persistence. *Cidaris* has subsisted from the Trias to the present day.

Cretaceous.—Herr A. Schenk has described the fossil woods of the Libyan desert belonging to the Upper Cretaceous. Many are petrified.—At the Academy of Sciences of Paris (May 25), M. Hebert presented a note by M. Ch. Velain upon the Penian formation, which in the Vosges takes a large share in the constitution of the secondary chains, filling some very large depressions. Except at some points where it is raised to the summit of mountains 600 to 800 meters high, it is covered by the Vosgian sandstone, and it lies upon the Carboniferous or gneiss. It is usually a red clayey sandstone, passing into a fragmentary conglomerate which unites it to the Vosgian below.

Tertiary and Quaternary.—The British Eocene land Mollusca are treated of by J. S. Gardner, in the *Geological Magazine* for June, 1885.—C. Schwager enumerates the foraminifera of the Eocene of Egypt and the Libyan desert. About sixty new species are described, excluding the nummulites which have been monographed by P. de la Harpe, and of which twenty-five species occur. The Eocene corals of the same region have been described by E. Pratz.—Messrs. P. M. Duncan and W. P. Sladen have monographed the Tertiary Echinoidea of Kachh and Kattywar (*Palæontologia Indica*, Ser. xiv). The Eocene of this region is classified in four groups, the two uppermost of which contain Echini. In the nummulitic group of Kachh twenty-two species were found, in the Oligocene above it five species, and in the Miocene sixteen species. All the Echini of Kattywar were Miocene, and

of the thirteen species six occurred in the Miocene of Kachh. Thirty-one of the foregoing are new. The same authors have monographed the Echini of Scinde, in all twenty-six genera and forty-two species, about twenty-six of which are new.—Th. Fuchs has described the Miocene fauna of Egypt and the Libyan desert. His work brings the neogene species of Lower Egypt up to 129. The new species are *Turritella distincta*, *Pholas ammonis*, *Pecten zitteli*, *fraasi* and *geneffensis*, *Ostræa vestita* and *pseudo-cucullata*, *Placuna miocenica*, *Brissopsis fraasi*, *Agassizia zitteli*, *Echinolampas amplius*, *Clypeaster rohlfsi*, *sub-placunarius* and *isthmicus*, *Scutella ammonis* and *rostrata*, and *Amphiope truncata* and *arcuata*.—*Cervalces americanus* Scott = *Cervus americanus* Harlan, is described by Professor W. B. Scott (*Science*, 1885, 420) from an almost perfect skeleton found in Warren county, N. J. It was a very large animal, with large head, short neck and trunk, legs much longer than those of the great Irish deer, and antlers which were palmated, though less so than in the moose. There is a bezant antler and a posterior tine given off from the beam opposite to it. The two tines are connected by a flaring process of bone which descends below the level of the eye. The premaxillæ are stag-like, and join the nasals, which are much longer than in the moose. The nostrils were smaller, and there was evidently no such a proboscis-like snout as in the moose. *Cervalces* agrees with the moose in having the lower ends of the lateral metacarpals present, and on the whole is more like *Alces* than it is like *Cervus*.—Professor Owen (*Trans. Zoöl. Soc. London*, 1883) describes the skeleton of *Dinornis parvus*. This smallest of the genus has proportionally the largest skull.—The *Geological Magazine* for April contains an interesting article upon the oscillations of level on the south coast of England. The May issue of the same magazine has an account of the inland seas and salt lakes of the glacial period, by T. F. Jamieson.—A new locality for diamonds is Salobro (brackish) behind the flat coast of the southern part of the province of Bahia, near the junction of the Rio Purdo with the Jequitinhonha, at the foot of the Serra do Mar. The diamonds occur in a disintegrating clay, apparently of quite recent origin, resembling the alluvium of existing rivers, and not exhibiting that rounding of the materials usually so characteristic of Brazilian diamond sands. It encloses few minerals compared with other sands; quartz is most common, next monazite in yellow and red crystals and zircon in brown to white, but seldom violet crystals; while staurolite, almandine, corundum and various iron ores are rarer. This is the first occasion in which corundum has been found in diamond beds, while tourmaline and other characteristic minerals are wanting.—Mr. D. Pidgeon (*Quart. Jour. Geol. Soc.*) gives an account of some recent discoveries in the submerged forest of Torbay, Eng., and maintains, contrary to received opinion, that “while some of the so-called peat-beds

of the forest are not older than Roman times, the clays in which the forest is rooted are either coëval with or younger than the bronze age in Britain." In December, 1883, the sea tore away the beach so as to expose this clay, at the junction of which with the Trias were found hearths of trap rock with bits of pottery, grindstones, glass, tin, slag and ingots of copper, leading to the conclusion that tin was smelted and bronze made prior to the deposition of the forest clay upon the surface of the Trias rock. Submergence need not be predicated, the damming back of the sea and the growth of trees below high-water mark behind the dam furnish a probable explanation of the phenomena.

MINERALOGY AND PETROGRAPHY.¹

AMPHIBOLE-ANTHOPHYLLITE FROM MT. WASHINGTON, BALTIMORE COUNTY.—A light-gray or brownish colored mineral, with a bronzy luster, occurs in considerable quantity as a gangue of the chalcopryite ore which is mined a short distance north-west of the village of Mt. Washington, Baltimore county, Md. It is most frequently found in thin blade-like individuals varying much in size and with only faint indications of crystal planes. Such masses contain, beside the chalcopryite, abundant, sharply defined octahedral crystals of magnetite. The bronzy mineral has a fibrous structure and in all respects resembles anthophyllite. During the past fall blades of unusual size ($10^{\text{cm}} \times 2^{\text{cm}}$) were found, which had the planes $\infty P \infty$ and ∞P of the prismatic zone well developed. The angle between the planes of the prism ($124^{\circ} 30'$) placed the hornblendic nature of the mineral beyond a doubt. The great purity and transparency of some of the material seemed to invite a chemical and optical examination which was accordingly undertaken by Mr. C. S. Palmer, of the chemical laboratory of the Johns Hopkins University. Some specimens of a reddish-brown color were translucent—almost transparent—though 2^{mm} in thickness. In these the usual fibrous structure parallel to the vertical axis was hardly noticeable, but a parting parallel to a very flat clinodome was quite pronounced.

A chemical analysis of this freshest and most homogeneous material gave the following results:

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	Na ₂ O	K ₂ O	total
57.26	0.75	1.73	15.64	tr.	21.70	2.80	tr.	99.88

This will be at once recognized as the composition of a typical anthophyllite. The specific gravity is 3.068. No pleochroism is visible in thin sections, but in transparent crystals of considerable thickness a decided difference both in the color and intensity of the rays is observable. The one vibrating parallel to *c* is a light copper-red, while that parallel to *b* is yellow. Absorp-

¹ Edited by Dr. GEO. H. WILLIAMS, of the Johns Hopkins University, Baltimore.